



Fundamental frequency and articulation rate as acoustic correlates of sexuality and gender presentation

Liza Sulkin*

Abstract. The present study examines how gender presentation correlates with fundamental frequency (F0) and articulation rate in a population of 45 lesbian, bisexual and straight female and non-binary US English speakers. As speakers of all sexualities self-report more masculine gender presentation, their mean F0 lowers; however, more masculine-presenting lesbian speakers have significantly lower articulation rates than more feminine-presenting lesbian speakers, while straight speakers show the opposite pattern. These results support the role of gender presentation as a predictor of speech variation, add evidence to the existence of a lesbian speech style, and underscore the importance of examining intra-community variation.

Keywords. phonetics; queer linguistics; F0; articulation rate; sexuality; gender presentation

1. Introduction. The present paper explores the relationship between gender presentation – individual expression of gender through aspects of behavior and appearance – and acoustic correlates of speech. Gender presentation is especially salient within sexual minorities, including roles such as the *butch/femme* dichotomy in lesbian spaces. There is evidence that aspects of gendered behavior, such as choices related to the presentation of the human body, correlate with different speech patterns (Eckert 2000, 2006; Mendoza-Denton 2014; Calder 2019; Pratt 2020; Podesva 2021). Thus, the present work can refine the understanding of how gender presentation aligns with language use. Lesbian communities are especially ideal for exploring intra-group differences due to the well-documented presence of distinct identities within the community (Farquhar 2000; Eves 2004; Huxley 2013; Kennedy & Davis 1993).

Existing linguistic research has often homogenized the speech of queer people who are assigned female at birth (AFAB). Few papers examining acoustic production have included lesbian women as a group of interest (Moonwomon-Baird 1997; Waksler 2001; Pierrehumbert et al. 2004; Munson et al. 2006; Rendall et al. 2008; Camp 2009; Hazenberg 2012; Van Borsel et al. 2013; Podesva & Van Hofwegen 2014; Barron-Lutzross 2018; Cuddy 2019), while even fewer have included bisexual women (Munson et al. 2006; Rendall et al. 2008; Camp 2009; Hazenberg 2012; Barron-Lutzross 2018; Willis 2021). Moreover, most of these papers combined the data of lesbian and bisexual speakers into a single group in order to compare them to straight speakers. None of the papers in the literature review explicitly included non-binary participants in their research. The present work aims to not only expand the literature on lesbian and bisexual speakers – including non-binary people – but also study these groups of speakers separately from each other, building on the methodologies of Barron-Lutzross (2018) and Willis (2021). More generally, the goals of this research are to contribute to the understanding of minority community identities. Language is used to create and reinforce identities, social structures and power dynamics; studying queer identities and prioritizing minority groups supports a more holistic view of the interconnectedness of gender, sexuality and speech. Examining this interconnectedness allows for a more complete understanding of individual experience and identity, which in turn contributes to our understanding of language as a dynamic and socially embedded phenomenon.

* Boston University (liza@bu.edu).

2. Background. The present work will examine three potential acoustic correlates of gender presentation and sexuality: F0 mean, F0 dynamism and articulation rate. The following subsections will define each variable, summarize studies that specifically examine the variable with respect to gender and sexuality and touch upon the potential indexical field associated with it.

2.1. PROPERTIES OF F0. Fundamental frequency (F0) refers to the frequency of the lowest component wave in a speech signal; its perceptual correlate is pitch. F0 is by far the most salient index of masculinity and femininity in US English. Numerous studies (Brend 1975; Hillenbrand et al. 1995; Linke 1953; Linville & Fisher 1985; Murry & Singh 1980; Suire et al. 2020) have found that variation in F0 is closely tied to sex and gender in cisgender speakers, concluding that men have an F0 on average 100-200 Hz lower than women, as well as having a more condensed pitch range. Additionally, F0 is an important cue in perception of speaker masculinity and femininity, such as in the findings of Munson (2007), where changes in F0 were the most significant predictor of whether listeners rated a voice as masculine or feminine.

There is relatively little literature concerning queer women's language as a whole, and the results of the few production studies that compare queer women's speech to straight women's speech are mixed with respect to F0. Early studies compared lesbian and straight women only. Moonwomon-Baird (1997) found that two lesbian women had lower F0 means and smaller F0 ranges than two straight women. Waksler (2001) also looked at spontaneous speech in a larger sample: 12 lesbian women and 12 heterosexual women. The study ultimately found that pitch did not correlate with sexual identity; additionally, the study found that the lesbian women instead had a slightly (but not significantly) wider F0 range than the heterosexual women, contradicting existing cultural stereotypes of lesbian women's voices. Van Borsel et al. (2013) examined read speech in Dutch from 34 lesbian women and 68 heterosexual women and found lower F0 means and decreased F0 dynamism among the lesbian speakers, although these results may have been skewed by a higher proportion of smoking participants in the lesbian group.

Some studies collapse lesbian and bisexual speakers into one group: queer women. Munson et al. (2006) examined mean F0 and range as part of a larger experiment on acoustic phenomena in read speech among 11 straight female speakers compared to 1 bisexual and 10 lesbian female speakers of US English, finding no significant differences in mean F0 or range by sexuality. Rendall et al. (2008) studied F0 in a small sample of read speech among 125 speakers of Canadian English (34 straight men, 33 straight women, 29 gay/bisexual men and 29 gay/bisexual women). They found that while there were systematic differences in F0 production across sexualities, these differences were mostly accounted for by considering the height and weight of the speakers. Camp (2009) examined pitch patterns in the spontaneous speech of 19 Japanese speakers (12 lesbian/bisexual women and 7 heterosexual women), finding that the lesbian/bisexual speakers had significantly lower average pitch and lower minimum and maximum pitch as well as slightly (but not significantly) narrower pitch ranges (Camp 2009).

Most recently, however, several studies have found no significant differences in F0 mean or range by sexuality. Barron-Lutzross (2015) examined these variables in read speech among 54 lesbian, bisexual and heterosexual women; instead of sexuality, familiarity with the queer community appeared to be the strongest predictor for systematic variation among speakers. Cuddy (2019) found a significant difference in F0 mean (but not range) between 12 lesbians and 10 straight women. Finally, Holmes et al. (2024) examined spontaneous production of vowels in three words in British English ('bed,' 'cat' and 'go') among 175 women and found no significant

differences in F0 mean or range by sexuality. Ultimately, these studies cast doubt on the claim that there are production based differences in speech based on sexuality.

2.2. ARTICULATION RATE. Articulation rate refers to the number of syllables spoken over the course of a given duration, with pauses in speech excluded; similarly, speech rate refers to the number of syllables spoken over the course of a given duration with pauses included (e.g. Byrd (1992)). The majority of the sociophonetic literature referenced below surrounding these variables examines articulation rate over speech rate, likely because the inclusion of conversational pauses may artificially deflate speech rate values for speakers who pause more frequently.

Previous literature has come to mixed conclusions about the nature of the relationship between articulation rate and various social groups – and whether it even exists. Several studies have found some degree of variation in speech rate with respect to regional accents, gender, age and ethnicity. Byrd (1992) found not only that Northern speakers spoke faster than Southern speakers but also that men spoke 6.2% faster than women in the TIMIT corpus of US English, even when controlled for dialect and sentence type. Notably, Weirich & Simpson (2014) used the same data as part of a perception experiment, finding instead that women were perceived to speak faster than men across dialect and sentence type. Jacewicz et al. (2009) found that speakers of US English from Wisconsin ('Northern' speakers) consistently spoke faster than an age-, gender-, socioeconomic status- and education-matched group of speakers from North Carolina ('Southern' speakers) across both read and informal speech. Additionally, men tended to speak faster than women, but this effect only reached statistical significance among younger Southern speakers. On the other hand, Kendall (2009) did not find an effect of region on articulation rate but did find that the interaction of gender and ethnicity (and marginally, age) significantly correlated with articulation rate. Men again tended to speak faster than women, and white speakers spoke faster than non-white speakers. Nevertheless, the strongest predictor of articulation rate in the study was utterance length.

Additional studies have examined articulation rate as an indexing variable for social meaning beyond gender. Kendall & Wolfram (2009) compared the speech rate of three Roanoke Island African American sociopolitical leaders in public-facing and sociolinguistic interview contexts. They found that one of the speakers – the county commissioner, a highly educated woman who is the first African American to have been elected to her position – had a significantly slower speech rate when giving a public address commemorating a colony of freed African Americans on Roanoke Island (from which she is descended) to a majority European American audience. Kendall and Wolfram suggest that the change in articulation rate during a speech was meant to convey a more 'planned' and 'deliberate' quality (Kendall & Wolfram 2009). Pratt (2018) looked at speech rates among twelve cisgender young men who were students in a San Francisco Bay Area school's more popular social scene, finding that speakers with the higher speech rates were those who self-identified as 'loud,' while those with lower speech rates self-identified as 'low-energy or chill' (Pratt 2018). More recently, (Esposito & Gratton 2022) found that bodybuilders had consistently higher articulation rates than yoga instructors online, suggesting that articulation rate reflects the amount of energy exertion required by each type of exercise. These studies provide evidence that a relatively high articulation rate is associated with spontaneity and heightened energy, while a relatively low articulation rate is analogously associated with thoughtfulness and lowered energy.

Few studies have examined the relationship between sexuality and articulation rate. Podesva

et al. (2002) examined the spontaneous speech of an openly gay attorney and a libertarian party representative debating the role that the government should play in policing the rules of private voluntary organizations. The authors conclude from vowel duration measures that the gay speaker likely had a lower speech rate than the straight speaker, although it is unclear how this result may generalize due to the topic of conversation and non-comparable backgrounds of the speakers. Neither Barron-Lutzross (2018) nor Holmes et al. (2024) found any relationship between speech rate and sexuality among straight, bisexual and lesbian women.

2.3. LESBIAN COMMUNITY SUB-IDENTITIES. *Butch* and *femme* are colloquial terms used to describe more masculine and more feminine-presenting lesbians, respectively. The following definitions for *butch* and *femme* come from Eves (2004):

‘Butch’ and ‘femme’ are used by lesbians as both sexual and gender identities [that] draw on visual and aesthetic gendered discourses to construct subcultural spaces and counter-hegemonic discourses [...] Femmes linked sex and gender in a conventional way but challenged the connection between gender and sexual orientation by being attracted to women [...] Butch accounts disrupted the link between sex and gender, but their attraction to women can be seen as conventional.

In this sense, *butch* and *femme* lesbians exist in opposition to and not within the confines of a cisheteronormative society, despite cultural stereotypes that *butch* and *femme* lesbians are mimicking heterosexual relationships. In their series of interviews with working class lesbians who frequented bars in Buffalo in the mid-twentieth century, Kennedy & Davis (1993) similarly argue that while these archetypes initially emerged from culturally imposed gender roles, they are nevertheless uniquely lesbian terms that are a form of community solidarity as well as resistance to the status quo.

Outside of *butch* and *femme*, several participants describe themselves as *masc* and *chapstick*, and one as a *stud*. *Masc* is another label used for masculine-presenting lesbians, similarly to *butch*, and stands in opposition to *femme* (Bergroth 2020). *Stud* exclusively refers to Black/African American lesbians who adopt masculine forms of behavior and appearance (Lane-Steele 2011; Kerr 2013). *Chapstick* – derived from the older term *lipstick* which refers to feminine-presenting lesbians who are often perceived to be straight women – centers on being outside of exclusively masculine or feminine presentation and behavior (Morgan 2017; Bergroth 2020). While this list of archetypes is of course nonexhaustive, these terms nevertheless provide evidence towards some connection between each archetype and the expected appearance and behavior of the person it describes.

3. Research questions. The goal of the present work is to argue that an additional variable – gender presentation – can serve to further explain and illuminate the variation seen between lesbian, bisexual and straight speakers and that lesbian participants are using specific lesbian community personae related to gender presentation to develop their identities within speech. This goal is operationalized through the following research questions:

RQ1. Within a sample of lesbian, bisexual/pansexual and heterosexual AFAB speakers of US English, what is the relationship between gender presentation, sexuality and acoustic features of speech?

RQ2. Is there any evidence for lesbian community archetypes functioning as styles or personae?

4. Methods. In order to explore the relationship between gender presentation and speech, several acoustic and social variables were collected from speakers. The acoustic variables are: F0, F0 dynamism and articulation rate. The social variables are: age, ethnicity, gender identity, sexuality and gender presentation. Gender presentation was operationalized by asking speakers to place their gender presentation on a Likert scale ranging from 1 to 5, which was probed during the interview: “If there were a scale from 1 to 5, where 1 represents very feminine gender expression and 5 represents very masculine gender expression, where would you place yourself?”

Sociolinguistic interviews were conducted with 45 AFAB participants (15 lesbian, 15 bisexual, 15 straight) in the Boston area. Participants were recruited via posters in university LGBTQ+ safe spaces, lesbian bars and queer bookstores, advertising a speech study explicitly focusing on finding a ‘lesbian voice.’ Each participant was at least 18 years old and a native speaker of US English; all of the social variables described above were self-reported by the participants throughout the interview. The interviewer was the author of the present study and is a white cisgender *femme* lesbian; the lesbian identity of the interviewer was explicitly communicated to participants prior to the start of the study in order to encourage participants to speak openly about their experiences, as there is evidence that queer people style shift between safe (i.e. queer-friendly) and unsafe spaces (e.g. Khoo & Ilbury (2024)).

Recordings were made as 48kHz, 24bit .wav files using a Zoom H4n Pro on stereo mode with an AKG C520 condenser microphone. Each .wav file was edited in Praat (Boersma 2001) to remove interview questions and pauses over 100 ms. A copy of the edited .wav file was then converted to a .mp4 video file and uploaded privately to a *Vimeo.com* account created by the author to generate a transcription, which was downloaded as a .vtt and converted to a .txt. The audio file was then segmented into approximately 30 second intervals at pauses (typically after filler words like ‘um’) in Praat. The author listened to each interval, pasted in the corresponding transcription into the TextGrid, and corrected any errors made by the *Vimeo* software. The audio file and corresponding TextGrid was used for automatic segmentation of the audio using the Montreal Forced Aligner (McAuliffe et al. 2017); the author then manually inspected phone segmentation in the resulting TextGrid and adjusted inaccurate phone boundaries.

In every file, mean F0 was calculated at all vowel intervals using built-in Praat functions with default settings for female speakers (e.g. timestep = 0, pitch floor = 75 Hz, pitch ceiling = 600 Hz for creating a Pitch Object from the audio). F0 values outside of a 95% confidence interval were removed for each speaker. A chi-squared test found no significant difference in the proportion of each vowel produced by each speaker in each register, so F0 values were not adjusted for intrinsic vowel differences. The F0 dynamism metric was calculated using another Praat function described by Van Borsel et al. (2013), which took F0 measurements every 10 milliseconds and found the absolute value of the difference between all consecutive measurements; after removing outliers outside of a 95% confidence interval, these measurements were then added together and divided by the total duration of the sound file, yielding a measurement in Hz/s. Finally, articulation rate was measured in Praat using a script created by de Jong et al. (2021), which estimates the total number of syllable nuclei across a file and divides them by the total amount of speaking time in the file, yielding a value in syllables per second.

Table 1 summarizes demographic information collected from each participant in the study. The *region* column is based on the categories given in Labov et al. (2006).

speaker	sexuality	age	gender	presentation	ethnicity	region
34	lesbian	20	woman	1	Filipino	NYC/NJ
29	lesbian	28	woman	1	Jewish	New England
22	lesbian	19	non-binary	2	Chinese	California
12	lesbian	31	woman	2	White	Midland
31	lesbian	21	genderfluid	3	White	New England
33	lesbian	21	woman	3	Latina	NYC/NJ
36	lesbian	22	woman	3	Indian	Midland
13	lesbian	24	woman	3	Latina	Midland
19	lesbian	24	non-binary	3	Black	New England
9	lesbian	27	non-binary	3	White	New England
18	lesbian	23	woman	4	Jewish	New England
15	lesbian	25	butch	4	White	Midland
32	lesbian	25	woman	4	White	New England
27	lesbian	22	woman	5	Latina	New England
11	lesbian	26	woman	5	Black	South
17	bisexual	23	woman	1	Korean	South
41	bisexual	30	woman	1	White	New England
24	bisexual	20	woman	2	Korean	California
5	bisexual	24	non-binary	2	Black	Southern
14	bisexual	25	woman	2	Chinese/Indian/Jewish	Midland
4	bisexual	27	woman	2	White	New England
25	bisexual	27	non-binary	2	Japanese/Mexican	Midland
16	bisexual	19	woman	3	White	New England
28	bisexual	22	genderqueer	3	White	New England
10	bisexual	27	woman	3	White	Midland
2	bisexual	19	woman	4	Chinese	New England
20	bisexual	19	genderqueer	4	Chinese	South
1	bisexual	27	butch	4	White	New England
21	bisexual	23	woman	5	Latina	NYC/NJ
23	bisexual	19	non-binary	5	Chinese	NYC/NJ
35	straight	28	woman	1	White	New England
40	straight	30	woman	1	Black	New England
44	straight	23	woman	2	Black/White	California
3	straight	25	woman	2	White	New England
26	straight	25	woman	2	Black/White	Midland
7	straight	25	woman	2	White	California
45	straight	24	woman	3	Indian	New England
8	straight	27	woman	3	Mexican	South
30	straight	27	woman	3	Jewish	New England
37	straight	27	woman	3	Chinese	South
38	straight	29	woman	3	Chinese/Jewish	Midland
43	straight	34	woman	3	Japanese	NYC/NJ
39	straight	28	woman	4	White	New England
6	straight	34	woman	4	White	NYC/NJ
42	straight	26	woman	5	White	New England

Table 1. Demographic information and select interview responses from participants.

5. Results.

5.1. SUMMARIES. Table 2 provides the Pearson’s correlations for gender presentation and the acoustic measures examined in the present paper in spontaneous speech. The additional columns describe the number of participants included for each variable, the average number of tokens measured per participant, and the total number of tokens for each variable. Table 3 contains the Pearson’s correlations for each of the three subgroups of participants.

	presentation	participants	tokens (each)	tokens (total)
F0	-0.700 ***	45	2593	116693
F0 dynamism	-0.442 **	45	1	45
articulation rate	-0.016	45	1	45

Table 2. Pearson’s correlations of self-reported gender presentation scores with acoustic variables in spontaneous speech. Significant correlations ($p < .001$, $p < .01$, $p < .05$) are marked with ***, **, *, respectively, and moderate to high degrees of correlation ($|r| \geq 0.5$) are bolded.

	lesbian	bisexual	straight
F0	-0.810 ***	-0.736 **	-0.687 **
F0 dynamism	-0.305 *	-0.346	-0.704 **
articulation rate	-0.433 *	-0.051	0.600 **

Table 3. Pearson’s correlations of self-reported gender presentation scores with acoustic variables in spontaneous speech for lesbian, bisexual and straight participants. Significant correlations ($p < .001$, $p < .01$, $p < .05$) are marked with ***, **, *, respectively, and moderate to high degrees of correlation ($|r| \geq 0.5$) are bolded.

5.2. MEAN F0. Previous studies closely tie relatively low F0 to masculinity and relatively high F0 to femininity. Studies on queer populations have conflicting results, with some finding that queer women have a lower F0 than straight women (Moonwomon-Baird 1997; Camp 2009; Van Borsel et al. 2013; Cuddy 2019) and the majority finding no difference across sexuality (Waksler 2001; Munson et al. 2006; Rendall et al. 2008; Barron-Lutzross 2015; Holmes et al. 2024). Figure 1 visualizes the spontaneous speech mean F0 values for each sexuality group; immediately, we see that in this population, the lesbian speakers have a significantly lower mean F0 than bisexual and straight speakers, who do not differ significantly from each other. This result supports the pattern found by Moonwomon-Baird (1997), Camp (2009), Van Borsel et al. (2013) and Cuddy (2019), in which lesbian speakers (and for Camp, bisexual speakers as well) have lower mean F0 than straight speakers. The bisexual speakers also have a wider range of mean F0 measures than the lesbian and straight speakers. Interestingly, the majority of speakers have are on the lower end of typical F0 production for female US English speakers, which ranges from around 170 to 250 Hz (Brend 1975; Hillenbrand et al. 1995; Linke 1953; Linville & Fisher 1985; Murry & Singh 1980; Suire et al. 2020).

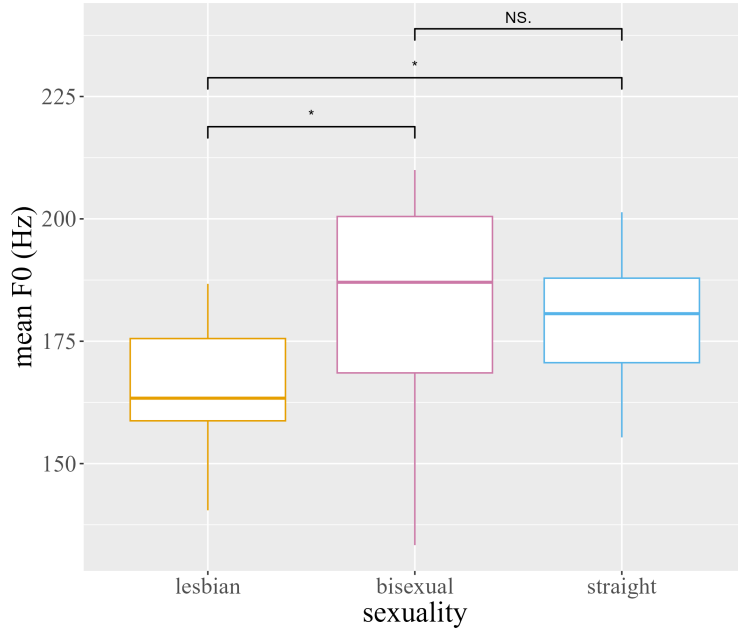


Figure 1. Mean F0 values for each speaker, color-coded for sexuality.

Figure 2 separates the data in Figure 1 into three facets by speaker sexuality. Here, it becomes clear that the three groups of speakers exhibit the same linear pattern, in which more masculine-presenting speakers have lower F0 than more feminine-presenting speakers.

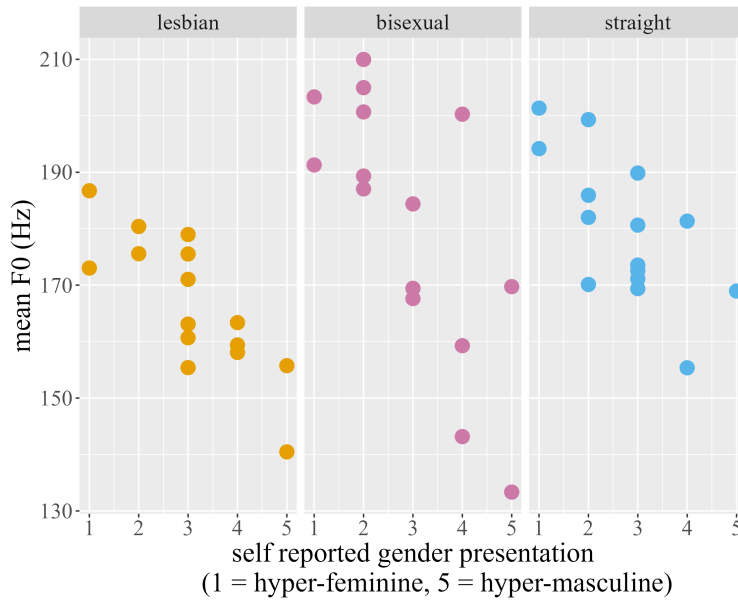


Figure 2. Spontaneous speech mean F0 values for each speaker, arranged by gender presentation and color-coded for sexuality.

A linear model was created to model the mean F0 data above. The dependent variables were centered gender presentation and sexuality, and the independent variable was mean F0. An ANOVA comparison was made between this model and the same model with interactions included, and there was no significant difference reported, suggesting that the model with interactions did not represent the data better than the model without interactions. The outputs of the model are summarized in Tables 4 (reference level: lesbian) and 5 (reference level: bisexual).

mean F0		
<i>Predictors</i>	<i>Estimates</i>	<i>p value</i>
(Intercept)	197.08	<0.001
gender presentation	-9.97	<0.001
sexuality [bisexual]	12.44	0.006
sexuality [straight]	9.89	0.028
R^2 / R^2 adjusted	0.583 / 0.553	

Table 4. Predictions made by a linear model using the formula $F0 \sim \text{gender_presentation} + \text{sexuality}$. The reference level of this model is a lesbian speaker whose gender presentation is 3. Bold p values represent statistical significance.

mean F0		
<i>Predictors</i>	<i>Estimates</i>	<i>p value</i>
(Intercept)	209.52	<0.001
gender presentation	-9.97	<0.001
sexuality [lesbian]	-12.44	0.006
sexuality [straight]	-2.55	0.559
R^2 / R^2 adjusted	0.583 / 0.553	

Table 5. Predictions made by a linear model using the formula $F0 \sim \text{gender_presentation} + \text{sexuality}$. The reference level of this model is a bisexual speaker whose gender presentation is 3. Bold p values represent statistical significance.

We see that, regardless of reference level, as gender presentation increases (that is, as speakers self-report presenting more masculinely), the model predicts that mean F0 lowers. Moreover, bisexual and straight participants are predicted to have higher mean F0 than lesbian participants, and there is no significant difference in mean F0 between bisexual and straight participants. This model accounts for over half of the variance in the data.

5.3. F0 DYNAMISM. Van Borsel et al. (2013), which introduced the F0 dynamism metric, found that lesbian speakers have a significantly lower F0 dynamism measure than straight speakers, which can be interpreted as lesbians having more monotonous voices than straight women. Figure 3 visualizes the spontaneous speech F0 dynamism measures for each sexuality group; there is no significant difference between the three groups. This result does *not* support the pattern found by Van Borsel et al. (2013).

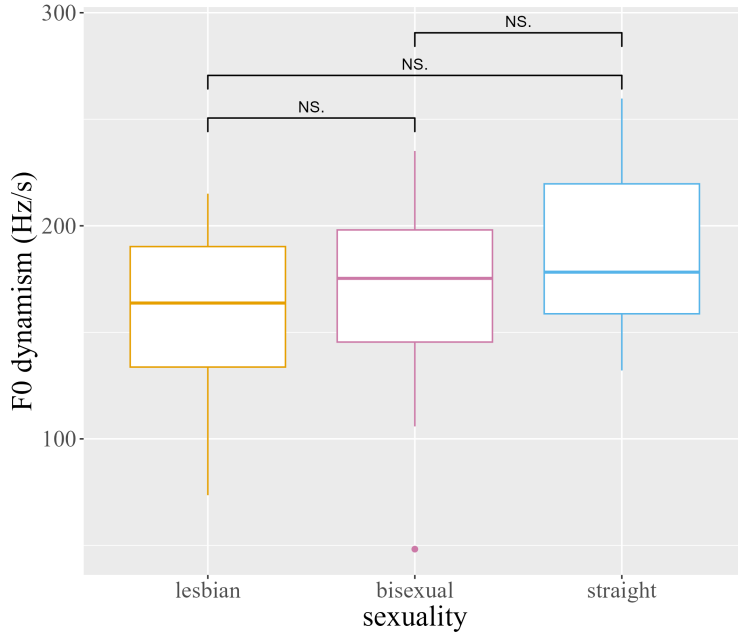


Figure 3. F0 dynamism values for each speaker, color-coded for sexuality.

Figure 4 separates the data in Figure 3 into three facets by speaker sexuality. Here, we see that while there is no difference in F0 dynamism across the three groups, there is nevertheless a prominent relationship between gender presentation and F0 dynamism for lesbian and straight speaker groups. Bisexual speakers do not share this pattern.

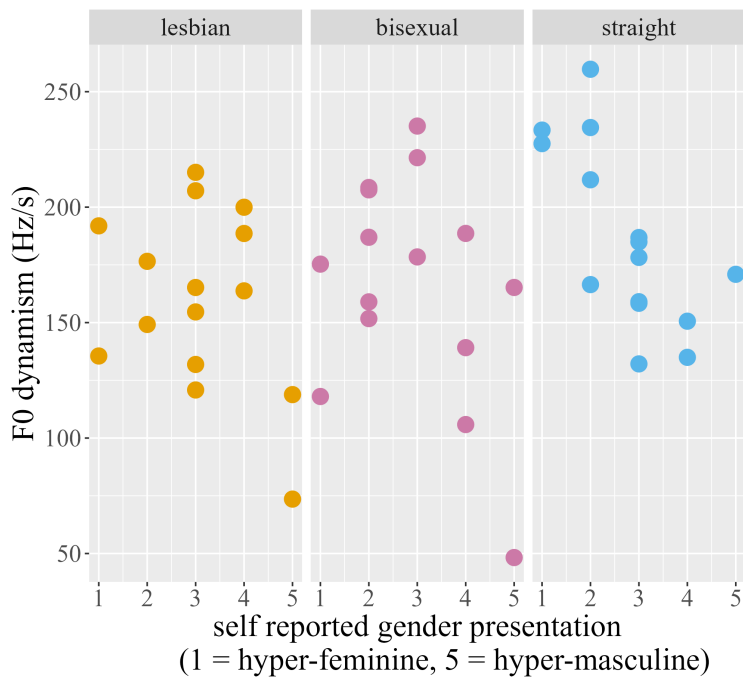


Figure 4. Spontaneous speech F0 dynamism values for each speaker, arranged by gender presentation and color-coded for sexuality.

A linear model was created to model the F0 dynamism data above. The dependent variables were centered gender presentation and sexuality, and the independent variable was F0 dynamism. An ANOVA comparison was made between this model and the same model with interactions included, and there was no significant difference reported, suggesting that the model with interactions did not represent the data better than the model without interactions. The outputs of the model are summarized in Tables 6 (reference level: lesbian) and 7 (reference level: bisexual).

F0 dynamism		
<i>Predictors</i>	<i>Estimates</i>	<i>p value</i>
(Intercept)	206.00	<0.001
gender presentation	-15.16	0.004
sexuality [bisexual]	3.40	0.812
sexuality [straight]	21.41	0.141
R ² / R ² adjusted	0.243 / 0.188	

Table 6. Predictions made by a linear model using the formula `pitch_dynamism ~ gender_presentation + sexuality`. The reference level of this model is a lesbian speaker whose gender presentation is 3. Bold *p* values represent statistical significance.

F0 dynamism		
<i>Predictors</i>	<i>Estimates</i>	<i>p value</i>
(Intercept)	209.40	<0.001
gender presentation	-15.16	0.004
sexuality [lesbian]	-3.40	0.812
sexuality [straight]	18.00	0.212
R ² / R ² adjusted	0.243 / 0.188	

Table 7. Predictions made by a linear model using the formula `pitch_dynamism ~ gender_presentation + sexuality`. The reference level of this model is a bisexual speaker whose gender presentation is 3. Bold *p* values represent statistical significance.

We see that, regardless of reference level, as gender presentation increases (that is, as speakers self-report presenting more masculinely), the model predicts that F0 dynamism lowers, that is, that speakers have more monotonous voices. Moreover, there is no effect of sexuality. This model accounts for about a quarter of the variance in the data.

5.4. ARTICULATION RATE. There was no predictive relationship between region and articulation rate, so all 45 speakers are included in the following results. Previous studies find some associations between relatively high articulation rates and masculinity and relatively low articulation rates to femininity. Only one study has examined articulation rates with respect to women’s sexuality, finding no relationship between articulation rate and sexuality (Holmes et al. 2024). Figure 5 visualizes the spontaneous speech articulation rate for each sexuality group; here, the bisexual group have significantly higher articulation rates than lesbian speakers, but there are no other significant differences between the groups. This result does not support the pattern found by Holmes et al. (2024). Interestingly, the bisexual speakers again have a wider range of articulation rate measures than the lesbian and straight speakers.

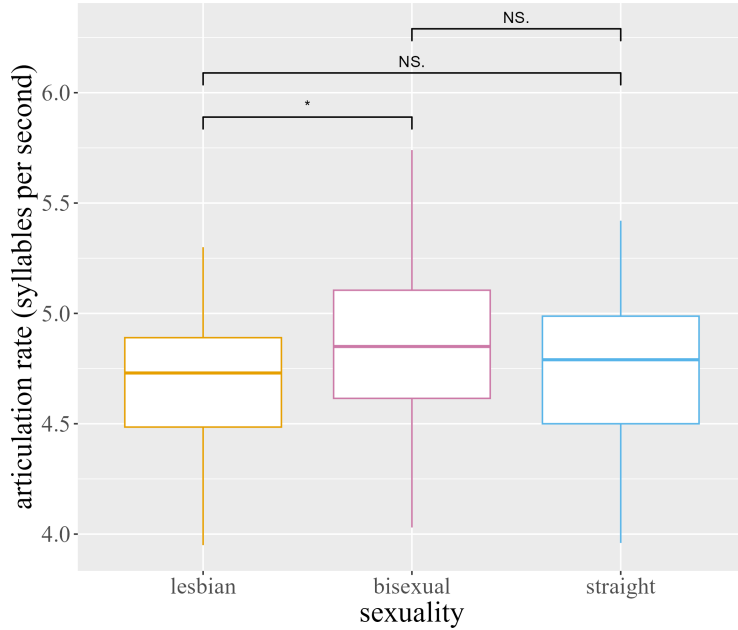


Figure 5. Spontaneous speech articulation rates for each speaker, color-coded for sexuality.

When the data is separated into three facets by sexuality in Figure 6, there are three different visible patterns. More masculine-presenting lesbian speakers have significantly *lower* articulation rates than their feminine-presenting counterparts; more masculine-presenting straight speakers have significantly *higher* articulation rates than their feminine-presenting counterparts. There is no correlation between gender presentation and articulation rate for the bisexual participants.

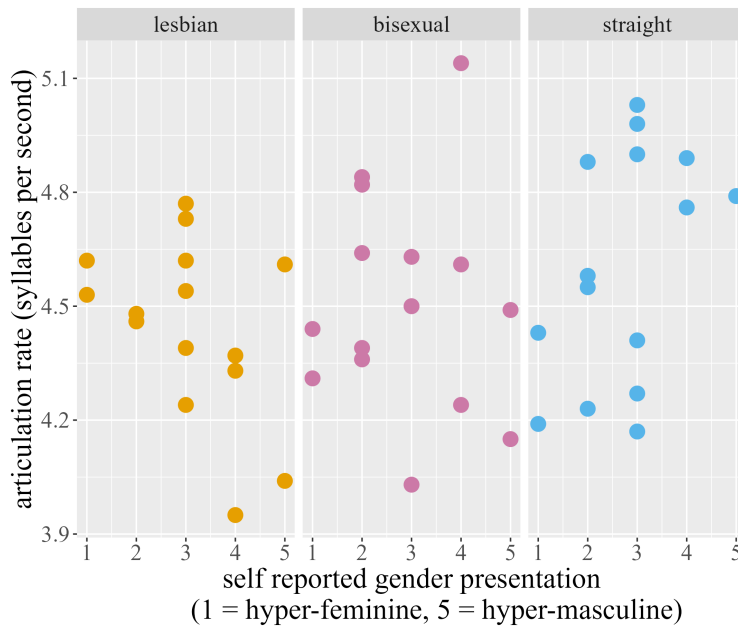


Figure 6. Spontaneous speech articulation rate values for each speaker, arranged by gender presentation and color-coded for sexuality.

A linear model was created to model the articulation rate data above. The dependent variables were centered gender presentation and sexuality, and the independent variable was articulation rate. An ANOVA comparison was made between this model and the same model with interactions included, and the model with an interaction between gender presentation and sexuality was considered a significantly better fit for the data. The outputs of the model are summarized in Tables 8 (reference level: lesbian) and 9 (reference level: bisexual).

articulation rate		
<i>Predictors</i>	<i>Estimates</i>	<i>p value</i>
(Intercept)	4.70	<0.001
gender presentation	-0.08	0.166
sexuality [bisexual]	-0.16	0.537
sexuality [straight]	-0.45	0.109
gender presentation \times sexuality [bisexual]	0.07	0.379
gender presentation \times sexuality [straight]	0.21	0.021
R^2 / R^2 adjusted	0.180 / 0.075	

Table 8. Predictions made by a linear model using the formula `articulation rate ~ gender_presentation + sexuality`. The reference level of this model is a lesbian speaker whose gender presentation is 3. Bold p values represent statistical significance.

articulation rate		
<i>Predictors</i>	<i>Estimates</i>	<i>p value</i>
(Intercept)	4.54	<0.001
gender presentation	-0.01	0.839
sexuality [lesbian]	0.16	0.537
sexuality [straight]	-0.28	0.277
gender presentation \times sexuality [lesbian]	-0.07	0.379
gender presentation \times sexuality [straight]	0.14	0.111
R^2 / R^2 adjusted	0.180 / 0.075	

Table 9. Predictions made by a linear model using the formula `articulation rate ~ gender_presentation + sexuality`. The reference level of this model is a bisexual speaker whose gender presentation is 3. Bold p values represent statistical significance.

Interestingly, neither of these models report gender presentation as a significant predictor of articulation rate; instead, in the model in Table 8, only the interaction between gender presentation and sexuality is a significant predictor, showing that a masculine-leaning straight participant would be predicted to have an increased articulation rate compared to the neutral lesbian participant reference level. This model accounts for a small part of the variance in the data.

6. Discussion. In order to further explore the unexpected results for articulation rate, I decided to examine speaker responses for additional data. The transcription of every interview was combined into one .txt file, and all punctuation and capitalization was removed. Words that could potentially have been spelled differently in the corpus (e.g. *fem* instead of *femme*) were changed.

This corpus was then loaded into AntConc, a software for text file analysis typically used in corpus linguistics (Anthony 2025) in order to search for collocates. The collocates of a specified word are a set of words that appear more commonly within a specified distance of that specified word in a specified text. A search was conducted with a standard 10 word window centered on the term *butch*; function words such as ‘and,’ ‘a’ and ‘is’ as well as the specified word were excluded from the tables. The resulting top 5 collocates of *butch* were: ‘femme,’ ‘lesbian,’ ‘masculine,’ ‘chill,’ and ‘relaxed.’

The top collocate for *butch* is *femme*; in fact, out of the approximately 356 total times that both *butch* and *femme* were used in the corpus, 97 of those times were in the phrases ‘butch and femme,’ ‘butch or femme’ and ‘butch femme.’ The remaining collocates for *butch* are ‘lesbian,’ ‘masculine,’ ‘chill,’ and ‘relaxed.’ All four collocates appeared most often in responses where speakers explicitly defined *butch*. While the first two collocates are relatively straightforward, the latter two are perhaps somewhat surprising. Words such as ‘chill’ and ‘calm’ appear frequently to describe a stereotypical *butch* lesbian. Speaker 31, a genderfluid lesbian, defines *butch* as ‘someone that’s more masculine presenting that identifies as a lesbian [...] it’s expanded so much like from that like vision of like all those um like butches that went to work in factories [...] but really now it could be like someone who’s a lot more calmer and down to earth and not, like, always in charge.’ Speaker 40, a straight woman, describes *butch* as ‘a woman who, like, stereotypically presents as more masculine, like dressing in a more masculine way, perhaps carrying themselves in a more masculine way [...] their voices are lower, they talk slower, they’re just, like, chill.’ Both of these speakers evoke ideas of a relaxed, calm persona associated with the *butch* label, with Speaker 40 even explicitly tying it to a ‘lower’ voice.

Other lesbian speakers described *butch* as a label with a changing meaning, such as Speaker 31, who describes the definition as ‘expanded’ from ‘butches that went to work in factories,’ or Speaker 9, a non-binary lesbian, who states: ‘in the fifties [butch] did refer to how you dress but it also kind of referred to, like, your role in the bedroom [...] but these days it’s like, it’s taking on sort of the some positive traits of masculinity I think without hopefully without taking on all of the negative ones [...] it’s less toxic and like, intense.’ Speaker 15, a butch lesbian, distinguished the categorizations of *butch* and *masc*: ‘Butch, it’s just got a bad rap [...] I feel like the reason people identify with masc more than butch is because butch has this connotation of, like, kind of like a bull dyke basically you know it’s like a big, you know, mean, tends to be like more controlling, like, a predatory lesbian stereotype.’ These speakers frame *butch* as a word that used to be associated with being ‘mean,’ ‘controlling,’ ‘always in charge,’ ‘predatory,’ or ‘toxic,’ but has now become ‘calmer,’ ‘down to earth,’ and ‘just chill.’

These descriptions – calm, chill, down to earth – are reminiscent of the indexical field of articulation rate, especially with the relationship between relatively low articulation rate and deliberate, thought-through speech or a laid-back personality and heightened or lowered embodied energy levels. Especially of note is Pratt (2018), which found that speakers with lower speech rates self-identified as ‘low-energy or chill.’ From the patterns in the present data, I claim that there is an emerging style or persona: that of a masculine lesbian. The acoustic phenomena associated with this persona are variants of three highly salient phonetic features: a low F0, (possibly) a monotonous voice, and a lowered articulation rate. The social meanings indexed by this style are a masculine, laid-back lesbian identity, and it is this very style that the speakers in this study may be using not only to distinguish themselves as masculine lesbians, but also to distance themselves from a more negative lesbian stereotype.

7. Non-effects and limitations. This study ultimately found no relationship between any of the acoustic variables and gender or ethnicity. The latter is surprising given numerous established studies linking race/ethnicity and acoustic production and speech styles (e.g. Willis & Youssef (2023); Calder & King (2020); Holliday (2016)); there is also evidence, however, that in formal spaces, speakers who are part of ethnic minorities may speak more similarly to their white counterparts (Holt & Rangarathnam 2018). In this study, not only were all speakers recorded in a university space, but they were also told that their recordings would be used as part of dissertation research done by the (cis, white, woman, graduate student) author. Additionally, all speakers were either undergraduate or graduate university students or young professionals; while socio-economic class was not explicitly probed as part of the interview, it is possible that the speakers were in similar socio-economic classes due to their access to higher education and well-paying jobs in the Boston area. All of these factors – environment, purpose, social identity and an interlocutor with that shared social identity and social power in that environment and purpose – could have led speakers to use a specific speech style in interviews that they felt was appropriate for an academic environment, which they likely had used before due to their own experiences in higher education. Thus, potential production differences could have been offset by the speakers’ backgrounds and the setup of the interviews. Future work could address these issues by interviewing speakers in different environments in order to holistically capture their style-shifting in different environments; or employ a range of interlocutors that had more social features in common with different speakers; or focus on recruiting speakers outside of academic spaces.

8. Conclusion. Several predictive relationships emerged between the examined acoustic phenomena and sexuality and gender presentation (as well as their interaction) in spontaneous speech. Lesbian speakers had significantly lower mean F0 than bisexual and straight speakers (who did not significantly differ from each other). For all three groups of speakers, as self-reported gender presentation increased (that is, as speakers self-reported presenting more masculinely), mean F0 lowered significantly. There was no relationship between sexuality and F0 dynamism. Interestingly, as self-reported gender presentation increased in spontaneous speech (that is, as speakers self-reported presenting more masculinely), F0 dynamism lowered significantly for lesbian and straight speakers (but not for bisexual speakers); we can interpret this to mean that more masculine-presenting lesbian and straight speakers have more monotonous voices than their more feminine-presenting counterparts. Once again, these results replicate previous work showing an association between more monotonous voices and masculinity. Articulation rate had a relationship with gender presentation, sexuality and their interaction. In spontaneous speech, bisexual speakers had significantly higher articulation rates than lesbian speakers. Additionally, as self-reported gender presentation increased (that is, as speakers self-reported presenting more masculinely), lesbian speakers had significantly decreased articulation rates while straight speakers had significantly increased articulation rates. Finally, a closer look at the results for masculine-presenting lesbian speakers shows evidence for a masculine lesbian speech style involving relatively low F0, a monotonous voice, and a lower articulation rate, which in turn indexes a masculine, laid-back lesbian identity.

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